CLAIMS

What is claimed is:

1. An apparatus for driving lasers, the apparatus comprising:

a laser current controller for providing a modulation signal and a bias signal;

a plurality of high-speed current drivers that accept the modulation signal and the bias signal and produce a plurality of laser drive signals; and

a disable input that selectively disables power to at least one high-speed current driver when the high-speed current driver is not in use.

2. The apparatus of claim 1 wherein the apparatus is integrated on an integrated circuit.

3. The apparatus of claim 2 further comprising an integrated array of lasers coupled to the plurality of high-speed current drivers for receiving the plurality of laser drive signals.

4. The apparatus of claim 1 wherein the laser current controller comprises:

an automatic power control (APC) input that accepts a digital APC signal; and

circuitry that adjusts the modulation signal and bias signal to the high-speed current drivers.

5. The apparatus of claim 1 further comprising

a high-speed current driver that drives a feedback laser; and

a feedback circuit that accepts a signal from the feedback laser and generates a modulation feedback signal and a bias feedback signal and provides them to the laser current controller.

6. The apparatus of claim 5 wherein the feedback circuit comprises:

a peak to peak detector that generates the modulation feedback signal; and

an average value detector that generates the bias feedback signal.

7. The apparatus of claim 1 further comprising at least one high-speed current driver, which does not have a disable input.

8. The apparatus of claim 6 further comprising a photo detector that detects laser light produced by a laser driven by one of the high-speed current drivers of the integrated driver and provides it to the peak detector and the average value detector.

9. The apparatus of claim 8 wherein the laser, which provides light to the photodetector, is a control laser, which is modulated by a signal of substantially lower frequency than a maximum frequency of the data lasers.

10. The apparatus of claim 8 wherein the modulating frequency is approximately 100 MHZ.

11. The apparatus of claim 9 wherein the frequency response of the photodetector is less than a maximum frequency of the data lasers and equal to or greater than the modulating frequency.

12. The apparatus of claim 8 wherein the peak detector comprises:

an input that accepts an output of the photo detector;

a capacitance that accepts the output of the photodetector from the peak detector input and holds the

output of the peak detector; and

means for producing a slow discharge of the capacitance.

13. The apparatus of claim 12 wherein the means for producing a slow discharge of the capacitance comprises:

a transistor, having a base collector and emitter, wherein the base of the transistor provides a discharge path for the capacitance; and

a constant current source coupled to the emitter circuit of the transistor.

14. The apparatus of claim 2 wherein the plurality of high-speed current drivers receive power from a first power supply, and the remainder of the integrated circuit receives its power from a second power supply thereby reducing the overall power consumed.

15. The apparatus of claim 10 further comprising a modulator that modulates the control laser with a signal having a lower frequency than a maximum frequency of any of the data lasers.

16. The apparatus of claim 15 wherein the maximum frequency response of the photo detector is lower than a maximum frequency of any of the data lasers.

17. An apparatus for driving lasers, the apparatus comprising:

a laser current controller for providing a modulation signal and a bias signal;

a plurality of high-speed current drivers that accept the modulation signal and the bias signal and produce a plurality of laser drive signals; and

a feedback circuit that detects laser light produced by a laser driven by one of the high-speed current drivers to produce a modulation feedback signal and a bias feedback signal for provision to the laser current controller.

18. An apparatus as in claim 17 wherein the laser current controller and the plurality of high-speed current drivers are integrated on an integrated circuit.

19 The apparatus of claim 18 further comprising a laser array integrated on the integrated circuit.

20. The apparatus of claim 17 wherein the feedback circuit further comprises a photo detector having lower frequency response than a maximum frequency of any of the data lasers.

21. An apparatus as in claim 17 further comprising a signal generator that generates a modulating signal that modulates the laser producing the laser light detected by the photo detector, said modulation signal being of substantially lower frequency than a maximum frequency of any of the data lasers.

22. An apparatus as in 17 wherein the feedback circuit comprises:

a photodetector that accepts the laser light and produces a proportional voltage;

a peak detector that accepts an output of the photo detector;

a capacitance that holds the output of the peak detector; and

means for producing a slow discharge of the capacitance.

23. An apparatus as in claim 22 wherein the means for producing a slow discharge of the capacitance comprises:

a transistor, wherein the base of the transistor provides a discharge path for the capacitance; and

a constant current source within the emitter circuit of the transistor.

24. The apparatus of claim 18 wherein the plurality of high-speed current drivers receive power from a first power supply,

and the remainder of the integrated circuit receives its power from a second power supply thereby reducing the overall power consumed.

25. An apparatus for driving lasers, the apparatus comprising:

a laser current controller for providing a modulation signal and a bias signal;

a plurality of high-speed current drivers that accept the modulation signal and the bias signal and produce a plurality of laser drive signals;

a disable input that disconnects power from a high-speed current driver when the high-speed current driver is not in use;

a feedback laser that is driven from one of the plurality of high-speed current drivers; and

a feedback circuit, including a photodetector that accepts light from the feedback laser and produces a modulation feedback signal and a bias feedback signal, said photodetector having a cutoff frequency lower than the maximum frequency of the high-speed current drivers.

26. The apparatus as in claim 25 further comprising a signal generator that modulates the feedback laser with a signal having a lower frequency than the maximum frequency of the high-speed current drivers.

27. An apparatus as in claim 25 wherein the feedback circuit further comprises:

a peak detector that accepts an output of the photo detector;

a capacitance that holds the output of the peak detector; and

means for producing a slow discharge of the capacitance.

28. An apparatus as in claim 27 wherein the means for producing a slow discharge of the capacitance comprises:

a transistor having a collector, emitter and base, wherein the base of the transistor provides a discharge path for the capacitance; and

a constant current source within the emitter circuit of the transistor.

29. The apparatus of claim 28 wherein the high-speed current driver and the laser current controller are integrated on the same integrated circuit.

30. The apparatus of claim 29 wherein the plurality of high-speed current drivers receive power from a first power supply, and the remainder of the integrated circuit receives its power from a second power supply thereby reducing the overall power consumed.

31. A method for controlling a laser the method comprising:

providing an integrated high-speed current driver in an integrated circuit;

driving an array of lasers from the integrated high-speed current driver;

accepting laser light from one of the array of lasers in a photodetector;

determining a maximum and a minimum level of light received from the laser that is providing light for the photodetector;

using the maximum and the minimum level of light received from the laser to produce a modulation feedback signal and a bias feedback signal;

using the modulation feedback signal and the bias feedback signal to produce a modulation and a bias signal; and

using the modulation signal and the bias signal to set the modulation and bias in the integrated high-speed current driver.

32. A method as in claim 31 wherein accepting laser light from one of the array of lasers in a photodetector comprises accepting laser light from a laser being modulated at a frequency less than the maximum frequency of the high-speed current driver.

33. A method as in claim 31 wherein accepting laser light from one of the array of lasers in a photocell comprises accepting laser light from a laser being modulated at a frequency of approximately 100 MHZ.

34. A method as in claim 31 wherein determining a maximum and a minimum level of light received from the laser that is providing light for the photocell comprises;

accepting a signal representative of the intensity of the laser light into a peak detector circuit; and

discharging the peak detector circuit by coupling a sampling capacitor, which holds peak detector voltage, to the base of an transistor and controlling the current of the transistor using a constant current supply.

35. An apparatus for driving a laser the apparatus comprising:

a current sink;

a differential pair of PNP transistors, each transistor having a base, emitter and collector the bases being coupled together, and the emitters being coupled to a supply voltage Vcc,

a differential pair of NPN transistors, each transistor having a base, emitter and collector the emitters being joined at a junction with the current sink, the bases providing the input across which and input signal is developed, and

a load junction of the collector of one of the PNP transistors and one of the collectors of one of the NPN transistors that is coupled to a laser load.

36. An apparatus as in claim 35 wherein the load junction is coupled to the base junction of the PNP transistors by a feedback resistor.

37. An apparatus as in 36 wherein the feedback resistor is coupled between the load junction and the base of a PNP feedback transistor; and

the emitter of the PNP feedback transistor is coupled to the base junction of the PNP differential transistor pair.

38. An apparatus as in claim 35 wherein the load junction is further coupled to a first end of a series resistor-capacitor circuit and the second end of the series resistor-capacitor circuit is coupled to ground.

39. An apparatus as in claim 35 wherein the load junction is further coupled to a first end of a series resistor-capacitor circuit and the second end of the series resistor-capacitor circuit is coupled to a power supply.

40. An apparatus as in claim 35 further comprising an inductor disposed between the load junction and the load.

41. A laser driver for driving a laser, the laser driver comprising:

a first control circuit for receiving power from a power supply and for providing current to drive a first laser; and

a switch located between the power supply and the control circuit,

wherein the switch is used to control the current provided to the laser.

42. The laser driver for driving a laser of claim 41, the laser driver further comprising:

a second control circuit for receiving power from the power supply and for providing current to drive a second laser,

wherein the second control circuit is coupled to the power supply with no switch between the second control circuit and the power supply.

43. The laser driver for driving a laser of claim 42 wherein the switch deactivates the first control circuit upon assertion of a power down select signal, while the second control circuit is not affected by the power down select signal.

44. A laser driver for driving a laser comprising:

a first feedback loop for adjusting a modulation current provided to the laser; and

a second feedback loop for adjusting a bias current provided to the laser.

45. The laser driver for driving a laser of claim 44 wherein the modulation current and the bias current are used to drive an array of lasers.

46. The laser driver for driving a laser of claim 44 wherein the modulation current is adjusted to control a peak-to-peak amplitude of a laser output.

47. The laser driver for driving a laser of claim 44 wherein the bias current is adjusted to control an average optical power of a laser output.

48. The laser driver for driving a laser of claim 44 further comprising an array of laser drivers, each laser driver for driving a corresponding laser, wherein the first feedback loop and the second feedback loop are used to adjust the modulation and bias currents for the array of laser drivers.

49. The laser driver for driving a laser of claim 44 wherein the first feedback loop includes a transimpedence amplifier (TIA) for converting a current generated by a feedback light into a feedback voltage used to adjust the modulation current.

50. The laser driver for driving a laser of claim 44 wherein the second feedback loop includes an amplifier for generating a feedback voltage used to adjust the bias current.

51. The laser driver for driving a laser of claim 48 wherein a particular laser corresponding to a particular laser driver is used to provide a feedback light to both the first and second feedback loops.

52. The laser driver for driving a laser of claim 48 wherein data transmitted using the laser has a pseudo random signal format or a format in which the data has a high statistical probability of having a sufficient number of consecutive "1's" so as to sufficiently charge a charge accumulation capacitor to enable detection of a value that is close to a peak value of a laser output.

53. The laser driver for driving a laser of claim 48 further comprising a control laser driver for driving a control laser, wherein the control laser is used to provide a feedback light to both the first and second feedback loops, and an oscillation frequency of a signal that drives the control laser driver is significantly lower than a frequency of a data signal provided to the array of laser drivers.

54. The laser driver for driving a laser of claim 52 wherein capacitance of the charge accumulation capacitor is adjusted to control a discharge time of the charge accumulation capacitor.

55. The laser driver for driving a laser of claim 52 wherein a base leakage current of a transistor is used to discharge the charge accumulation capacitor so as to lengthen a discharge time of the charge accumulation capacitor.

56. A laser driver for driving a laser comprising:

first circuitry for receiving approximately 2.5V power to perform various laser driver functions; and

second circuitry for receiving approximately 3.3V power to perform laser output stage functions.

57. A laser driver for driving a longwave VCSEL comprising:

control circuitry; and

laser output circuitry,

wherein a voltage lower than a typical low voltage for shortwave VCSEL is used to power the laser driver.

58. The laser driver for driving a longwave VCSEL of claim 57 wherein the voltage lower than the typical low voltage for shortwave VCSEL is less than or equal to approximately 1.5V.

59. The laser driver for driving a longwave VCSEL of claim 18 wherein a direct coupling is used to provide power to the laser driver so as to reduce power consumption associated with ac coupling.

60. A laser driver for driving a laser comprising:

A PNP current mirror to supply current for driving the laser,

wherein the PNP current mirror includes a feedback resistor that can be adjusted to flatten a low frequency dip in an ac magnitude response of a laser output.

61. An integrated circuit comprising:

means for setting a bias current and a modulation current and for delivering each of said bias current and said modulation

current to each laser driver of an array of laser drivers, each laser driver driving a laser of a corresponding array of lasers;

means for accepting P_{avg} information regarding an average optical output power of said lasers of said array of lasers;

means for accepting $P_{peak-peak}$ information regarding peak-peak power amplitude of said optical output of said lasers of said array of lasers;

means for adjusting said bias current based upon said P_{avg} information; and

means for adjusting said modulation current based upon said $P_{peak-peak}$ information.

62. The integrated circuit as in claim 61, further comprising a photodetector and associated circuitry capable of developing said P_{avg} information and said $P_{peak-peak}$ information.

63. The integrated circuit as in claim 61, wherein said lasers comprise VCSELs.

64. The integrated circuit as in claim 61, further comprising:

a further laser;

means for providing a pilot signal having a first frequency to said further laser; and

means for delivering a data signal to each laser of said array of lasers, each data signal having a second frequency being greater than said first frequency,

wherein said P_{avg} information and $P_{peak-peak}$ information are obtained from light emitted from said further laser.

65. A method for driving a VCSEL comprising:

providing a VCSEL and a corresponding VCSEL driver;

providing a bias current and a modulation current to said VCSEL driver to effectuate said VCSEL emitting a light signal including a first average power level and a first peak-to-peak power amplitude;

providing a data signal having a first data rate to said VCSEL driver;

detecting a second average power level and a second peak-to-peak power amplitude of a light signal emitted from a further VCSEL responsive to a further data signal having a further data rate being less than said first data rate; and

adjusting each of said bias current and said modulation current to maintain said VCSEL emitting light at said first average power level and said first peak-to-peak power amplitude based on said detecting.

66. A method for driving a VCSEL, comprising:

(a) providing a VCSEL and a corresponding VCSEL driver;

(b) providing each of a bias current and a modulation current to said VCSEL driver;

(c) providing a data signal having a first data rate being greater than 2.0 GBPS to said VCSEL driver;

(d) detecting an average power and a peak-to-peak power amplitude of an optical signal emitted by said VCSEL using a photodetector operating at a data rate being less than said first data rate; and

(e) adjusting each of said bias current and said modulation current to urge said VCSEL to emit a light signal having a desired average power and a desired peak-to-peak power amplitude.